



The Relationship Between Nonsuicidal Self-Injury Age of Onset and Severity of Self-Harm

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This study examined how age of nonsuicidal self-injury (NSSI) onset relates to NSSI severity and suicidality using decision tree analyses (nonparametric regression models that recursively partition predictor variables to create groupings). Those with an earlier age of NSSI onset reported greater NSSI frequency, NSSI methods, and NSSI-related hospital visits. No significant splits were found for suicide ideation or attempts, although those with an earlier onset were more likely to have a suicide plan. Overall, findings suggest that onset of NSSI before age 12 is associated with more severe NSSI and may be a crucial age for prevention efforts.

Nonsuicidal self-injury (NSSI), the direct, intentional destruction of one's own body tissue without the intent to die (Nock, 2009), occurs from preadolescence through adulthood (Hilt, Nock, Lloyd-Richardson, & Prinstein, 2008; Swannell, Martin, Page, Hasking, & St John, 2014; Taliaferro & Muehlenkamp, 2015). Although NSSI has been traditionally thought to begin during early adolescence (Nock, 2010), several studies support variation in age of NSSI onset. For example, approximately 20% of individuals reported NSSI onset between the ages of 11 and 13, while 17% reported NSSI onset over the age of 20 (Heath, Toste, Nedecheva, & Charlebois, 2008). The literature examining variability in NSSI onset has focused on what factors influence initial NSSI incidence (e.g., poor social support,

poor self-esteem, adverse life events; Andrews, Martin, Hasking, & Page, 2014; Voon, Hasking, & Martin, 2014). Less is known about the impact of NSSI onset on future NSSI trajectory.

Indirect evidence suggests that earlier NSSI onset may be indicative of a more severe NSSI course. For example, inpatient NSSI samples (Ferrara, Terrinoni, & Williams, 2012; Muehlenkamp & Brausch, 2012) report an average age of onset of 12, whereas studies of less severe, community samples (Muehlenkamp & Brausch, 2012; Nock & Prinstein, 2004) report a slightly older age of 13. Furthermore, results from a latent class analysis demonstrated that the class of self-injurers with earlier NSSI onset was more likely to report using multiple NSSI methods (Somers et al., 2015). Taken together, the

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literature indicates that age of NSSI onset may be related to increasingly harmful NSSI, which brings into question the relationship between NSSI onset and more potentially detrimental self-harming behavior.

There is mixed support for the idea that suicide risk among individuals who engage in NSSI may be impacted by NSSI age of onset (Klonsky, May, & Glenn, 2013; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). One study found that a class of self-injurers with later NSSI onset had a higher presence of lifetime suicidal ideation (Klonsky & Olin, 2008), whereas a similar study found the class with earlier NSSI onset to be more likely to report recent suicidal ideation (Somer et al., 2015). Further, later NSSI onset was initially related to a higher proportion of self-injurers having attempted suicide (Klonsky & Olin, 2008), but a more recent study failed to replicate these findings (Somer et al., 2015). Notably, no studies have directly examined NSSI onset as a predictor of NSSI severity or suicidal thoughts and behaviors. A more direct examination of these relationships may shed light on previous inconsistent findings.

To our knowledge, no study has directly examined the age of NSSI onset as it relates to NSSI severity and suicidal thoughts and behaviors. In this study, we addressed this gap by directly examining how age of NSSI onset relates to NSSI severity and the presence of suicidality. NSSI characteristics considered indicative of NSSI severity, including lifetime and past-year NSSI frequency (Paul, Tsypes, Eidlitz, Ernhout, & Whitlock, 2015), number of NSSI methods used (Anestis, Khazem, & Law, 2015; Victor & Klonsky, 2014), and number of hospital visits due to NSSI acts, were investigated. Additionally, suicidal thoughts and behaviors (i.e., suicidal ideation, suicide plans, and suicide attempts) were examined in relation to NSSI age of onset. To best assess the age of NSSI onset that optimally discriminates between self-injurers on these variables, we used decision tree analyses. Decision trees can be thought of as nonparametric

regression models where the predictor variables are recursively partitioned to create groupings of individuals with similar response values. In addition to providing better prediction accuracy in many cases than traditional linear regression (McArdle, 2012), the popularity of decision trees can be attributed to the graphical nature and ease of interpretability. Based on previous research examining NSSI characteristics, we hypothesized that individuals with earlier NSSI onset would demonstrate more severe NSSI behavior (i.e., greater frequency, number of methods used, and number of hospital visits). However, due to inconsistent previous research findings, no specific hypotheses were made in regard to suicidal thoughts and behavior.

METHOD

Participants and Procedures

Participants were 957 undergraduates (69% female; M age = 20.69 years, SD = 3.00, range = 17–43) who had engaged in at least one NSSI act during their lifetime. Approximately 65% of the sample identified as Caucasian, 10% as African American, 12% as Asian, 6% identified as biracial, 5% identified as “Other,” and 2% preferred not to answer. On a secure website and for course credit, participants completed informed consent and a series of self-report measures as part of a larger institutional review board-approved study on self-aggression.

Measures

Nonsuicidal Self-Injury. The presence of NSSI was assessed with the Form and Function of Self-Injury (FAFSI; Jenkins, Connor, & Alloy, 2011), which inquires about 13 different forms of NSSI, the age individuals first engaged in each form (the youngest age being considered NSSI onset), the number of times they engaged in each form (lifetime and past year), and the number of times they hurt themselves so

severely they went to the hospital. The sum of different NSSI forms endorsed indicated the number of NSSI methods. The internal consistency of the FAFSI has been supported (Jenkins et al., 2011), and the measure has been used in previous studies examining NSSI (Ammerman, Burke, Alloy, & McCloskey, 2016; Kleiman et al., 2015).

Suicidal Thoughts and Behaviors. The Suicide Behavior Questionnaire-Revised (SBQ-R; Osman et al., 2001) is a four-item self-report measure. Only one item from this measure was used to determine the presence of lifetime suicidal ideation, suicide planning, and suicide attempts. Each thought/behavior was categorized as present (coded as 1) or absent (coded as 0). The measure's internal consistency has been established, $\alpha = .76$ (Osman et al., 2001).

Data Analysis

As all procedures were completed online, validity items (e.g., "select 3 for this item") were included throughout all measures, and only those participants who responded appropriately to over 70% of the validity items were included in the analyses. Decision tree analyses were used to determine the best NSSI age of onset to discriminate between groups on all study variables. In decision trees, the predictor variables are recursively partitioned to create groupings of individuals with similar response values. This results in inequalities on the individual dimensions of the covariate space, which can then be read like a rule set. Hothorn, Hornik, and Zeileis's (2006) unbiased classification tree algorithm implemented in the R package *party* (R Core Team, 2015; Hothorn, Hornik, Strobl, & Zeileis, 2015) was used for the analyses. To prevent trees from growing too large (i.e., reducing interpretability and generalizability), the Hothorn et al. (2006) method uses $p < .05$ for variable selection; however, as seven different tree structures were examined, the default was adjusted using a Bonferroni correction ($p \leq .0073$). It is of note that the lifetime NSSI variable was significantly skewed; this did not impact the

tree analysis because it is sensitive to outliers and monotonic transformations in predictor variables (Hastie, Tibshirani, & Friedman, 2009). It is also important to note that the arrived-upon split in each tree structure is the *most* informative split. That is, the findings do not suggest that other splits were not informative, but that the presented split was the most informative.

RESULTS

Preliminary Analyses

The average age of NSSI onset was 13.90 years ($SD = 3.15$) and ranged from 5 to 27 years old. On average, participants engaged in 172 acts of NSSI throughout their lifetime (median = 8; range = 1–20,000; $SD = 1,423.44$), 10 acts of NSSI in the past year (median = 0; range = 0–1,002; $SD = 69.28$), and used two methods (range = 1–11; $SD = 1.59$) throughout their lifetime. Number of hospital visits due to NSSI ranged from 0 to 5, with 9% reporting at least one visit. Nearly three quarters (72.4%) of participants reported lifetime suicidal ideation, 36.4% reported lifetime presence of a suicide plan, and 13.5% reported having attempted suicide sometime in their life.

NSSI Characteristics

An overview of NSSI characteristics is provided in Table 1. In predicting lifetime NSSI frequency, the most informative split in NSSI age of onset was between participants with an age of onset before and after the age of 11 ($p = .005$). Participants with NSSI onset at or before age 11 reported an average of 448.13 lifetime NSSI acts, whereas those with an onset greater than 11 reported an average of 118.77 lifetime NSSI acts. There were no additional significant splits.

In predicting past-year NSSI frequency, the most informative split in NSSI age of onset was between participants with

an age of onset before and after the age of 10 ($p < .001$). Participants with NSSI onset at or before age 10 reported an average of 32.87 NSSI acts in the past year, whereas those with an onset after the age of 10 reported an average of 18.09 NSSI acts in the past year. There were no additional significant splits.

In predicting number of NSSI methods, the most informative split in NSSI age of onset was between participants with an age of onset before or after the age of 16 ($p < .001$). Participants with NSSI onset after age 16 reported using an average of 1.20 NSSI methods. Among those with NSSI onset at or before age 16, there was a second significant split before or after the age of 11 ($p < .001$). Participants with NSSI onset at or below age 11 reported using an average of 3.01 NSSI methods. Among those with NSSI onset after age 11 and at or before age 16, there was a third significant split with age of onset before or after the age of 13 ($p = .007$). Participants with NSSI onset after the age of 11 and at or before the age of 13 reported an average of 2.37 NSSI methods, whereas participants with NSSI onset after the age of 13 and at or before the age of 16 reported an average of 2.11 NSSI methods. There were no additional significant splits.

In predicting number of hospital visits due to NSSI, the most informative split in NSSI age of onset was between participants with an age of onset before or after the age of 10 ($p < .001$). Participants with NSSI onset at or before age 10 reported an average of 0.30 hospital visits, whereas those with NSSI onset after age 10 reported 0.09 hospital visits. There were no additional significant splits. As age is often correlated with number of hospital visits, this tree was also conducted controlling for age; the results were the same.

Suicidal Thoughts and Behaviors

In predicting the presence of lifetime suicidal ideation, there were no significant splits in NSSI age of onset. In predicting the

presence of lifetime suicide plan, the most informative split in NSSI age of onset was between participants with an age of onset before or after the age of 12 ($p < .001$). Fifty percent of participants with NSSI onset at or before the age of 12 reported a suicide plan, whereas 31% of those with NSSI onset after the age of 12 reported a suicide plan. There were no additional significant splits. In predicting the presence of lifetime suicide attempts, there were no significant splits in NSSI age of onset.

DISCUSSION

The current study directly examined how age of NSSI onset related to NSSI trajectory and the presence of suicidal thoughts and behaviors. Decision trees indicated that those with a young NSSI onset were more likely to report more severe NSSI. In contrast, these analyses indicated that age of NSSI onset may not be a driving factor in suicidal behavior.

The current findings are consistent with indirect evidence that early NSSI onset may be related to NSSI severity (e.g., Muehlenkamp & Brausch, 2012). Those with an earlier age of onset (i.e., younger than 12) reported greater lifetime and past-year NSSI frequency. It is not unexpected that individuals who began engaging in NSSI sooner would have engaged in NSSI more times (simply due to having more opportunity); however, they also reported greater NSSI frequency in the past year. Consistent with these findings, individuals with earlier onset reported using a greater number of NSSI methods, supporting previous research (Somer et al., 2015), and having visited the hospital a greater number of times due to NSSI acts. It is possible that these individuals simply had more time to experiment with NSSI methods and more occasions to engage in severe NSSI; however, it may also be that they habituated to one, primary method and began trying other forms of NSSI to increase pain or severity, a conjecture potentially supported

TABLE 1
Decision Tree Splits for NSSI Characteristics and Suicidal Thoughts and Behaviors

	Onset Split 1	Group 1 (N, M)	Group 2 (N, M)	Onset Split 2	Group 1 (N, M)	Group 2 (N, M)	Onset Split 3	Group 1 (N, M)	Group 2 (N, M)
Lifetime NSSI frequency	11	≤11 (155, 448.13)	>11 (802, 118.77)	—	—	—	—	—	—
Past-year NSSI frequency	10	≤10 (123, 32.87)	>10 (831, 18.09)	—	—	—	—	—	—
Number of NSSI methods	16	≤16	>16 (161, 1.30)	11	≤11 (155, 3.01)	>11	13	>11 & ≤13 (270, 2.37)	>13 & ≤16 (371, 2.11)
Number of hospital visits	10	≤10 (123, 0.30)	>10 (832, 0.09)	—	—	—	—	—	—
Suicidal ideation	—	—	—	—	—	—	—	—	—
Suicide plan	12	≤12 (264, 0.50)	>12 (693, 0.31)	—	—	—	—	—	—
Suicide attempt	—	—	—	—	—	—	—	—	—

by the finding that these individuals were more likely to seek medical attention for their wounds. Overall, findings suggest that those who initiate NSSI at an earlier age are more likely to maintain a more severe pattern of NSSI over a longer duration.

No differences in the presence of suicidal ideation based on NSSI age of onset were found, which is inconsistent with previous research examining both lifetime (Somer et al., 2015) and past-year (Klonsky & Olino, 2008) ideation. It may be that the high level of suicidal ideation endorsed in the current sample, which more closely resembles a psychiatric sample (70% endorsement; Victor, Styer, & Washburn, 2015) than a self-injuring undergraduate sample (50% endorsement; Klonsky & Olino, 2008), may account for such discrepancies, as previous research has shown a weaker link between NSSI age of onset and suicidal ideation in psychiatric samples (e.g., Victor et al., 2015). Despite the absence of differences in ideation, those with an earlier age of NSSI onset were more likely to report a suicide plan. That is, these individuals were more likely to progress from thoughts of their death to demarcating a plan to carry out their own death.

NSSI age of onset did not differentiate lifetime suicide attempts. Both greater NSSI frequency and NSSI methods are associated with suicide attempts (Paul et al., 2015; Victor & Klonsky, 2014), potentially through their contribution to one's acquired capability for suicide (a primary ingredient for suicidal behavior; Joiner, 2005; Klonsky & May, 2015). Therefore, we would expect those with an earlier NSSI onset, given their increased NSSI frequency and greater number of methods, to be more likely to report a history of suicide attempts. The presence of suicide attempts in the current sample (13.5%) is lower than expected when compared with previous research among those with a history of NSSI (e.g., 30%; Muehlenkamp & Gutierrez, 2007). It is possible that the current sample is unique in their (lower) severity of suicidal behavior (but not ideation), which could have ultimately influenced our findings. We believe,

however, that the current results may demonstrate that age of NSSI onset does not discriminate between individuals who think about suicide and those who act on these thoughts, but only those who mentally prepare for suicidal behavior.

Overall, our results suggest that earlier NSSI onset is associated with more severe NSSI and the presence of suicide planning. When considering this, we might then ask what age should be considered “early” onset for NSSI? The current analyses indicate that “early” NSSI may be defined, most notably, before the age of 12. Individuals who began engaging in NSSI before age 12 had greater lifetime and past-year NSSI frequency, used a greater number of methods, had more hospital visits, and were more likely to have a suicide plan. As such, those who initiated NSSI behavior before the age of 12 represent the majority of individuals at highest risk, which may be particularly informative in clinical settings.

The current study relied on self-report measures within a cross-sectional framework. Consequently, this precludes us from suggesting that age of NSSI onset is a prospective risk factor for suicide planning. Further, the mean age of participants in the current sample was 20 years old; it is possible that if assessed at a later age, these individuals may have reported engaging in more severe NSSI or suicidal behavior. Despite these limitations, the current study has important clinical implications for preventative efforts and risk assessment for NSSI severity. Our finding that the onset of NSSI before age 12 was associated with more severe NSSI suggests that preadolescence may be a crucial age for prevention efforts, such as school-based programs to reduce stigma surrounding NSSI help-seeking. Further, individuals who begin NSSI at an early age may greatly benefit from treatment due to their high risk for severe and chronic NSSI, and treatments may consider tailoring interventions to this specific age range.

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